Chapter 2 · Polynomials

The Interactive Puzzle Collection

Step up to the board.

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Practice Set A · Fluency

(Aim for speed and accuracy)

Q1: Write the degree of each polynomial: **(i)** $5x^3 - 4x^2 + x - 2$ **(ii)** $4s^2 - 4s + 1$ **(iii)** 7	
Q2: Classify each as linear, quadratic or cubic: **(i)** $2x - 3$ **(ii)** $6x^2 - 3 - 7x$ **(iii)** $2x^3$	
Q3: Find the zero of the linear polynomial $3x - 9$.	
Q4: If $p(x) = x^2 - 3x - 4$, find $p(0)$ and $p(2)$.	
Q5: Find the zeroes of $4u^2 + 8u$.	
Q6: Find the zeroes of $t^2 - 15$.	
Q7: How many zeroes can a cubic polynomial have at most?	
Q8: Is $\frac{1}{x-1}$ a polynomial? Give a reason.	

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Practice Set B · Reasoning

(Multi-step. Show every line.)

Q1: Find the zeroes of $6x^2 - 3 - 7x$ and verify the relationship between zeroes and coefficients.	
Q2: Find the zeroes of $4s^2 - 4s + 1$ and verify the relationship between zeroes and coefficients.	
Q3: Find the zeroes of $3x^2 - x - 4$ and verify the relationship between zeroes and coefficients.	
Q4: Find a quadratic polynomial with sum of zeroes -1/4 and product of zeroes 1/4.	
Q5: Find a quadratic polynomial with sum of zeroes 0 and product of zeroes 5.	
Q6: Find a quadratic polynomial with sum of zeroes 4 and product of zeroes 1.	
Q7: A graph of y = p(x) touches the x-axis at exactly one point. How many zeroes does p(x) have, and what does this tell you about the two zeroes of the quadratic?	

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Practice Set C · Challenge

(Stretch problems. One may beat you — that is fine.)

Q1: Find a quadratic polynomial with sum of zeroes 2 and product of zeroes 1/3.	**Q2:** If one zero of the quadratic polynomial $x^2 + 3x + k$ is 2, find the value of k.
Q3: Verify that 2, -1 and -1/2 could be zeroes of a cubic of the form $2x^3 - x^2 - 5x - 2$ — check by substitution and verify the sum/product relationships.	**Q4:** The graph of a polynomial $p(x)$ crosses the x-axis at exactly 3 points and touches it at one more point without crossing. What is the least possible degree of $p(x)$? Explain.
Q5: Show that x=1/2 is a zero of $2x^2 - x$ and find its other zero.	

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The Crossnumber

(Answers are numbers. One digit per square.)

ACROSS:

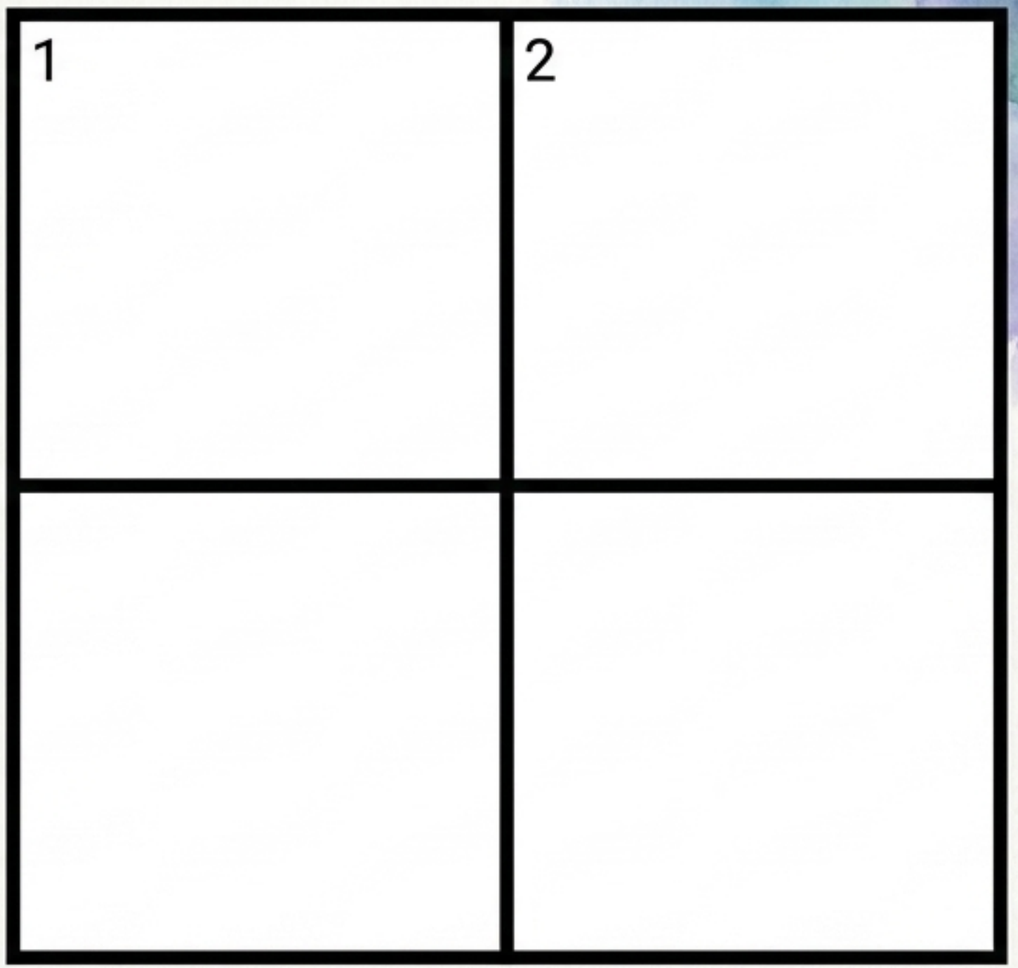
1. Constant term of $x^2 + 7x + 10$ (2 digits)

DOWN:

1. Degree of a linear polynomial (1 digit).

2. $p(x) = x^2 - 3x - 4$, evaluate $p(4)$ (1 digit).

***Bonus questions:** The larger zero of $x^2 - 3x - 4$; |Sum of zeroes| of $x^2 + 7x + 10$; Constant term of $2x^3 - 5x^2 - 14x + 8$; Degree of a quadratic polynomial; Degree of a cubic polynomial; Product of zeroes of $x^2 + 5x + 6$; |Sum of zeroes| of $x^2 - 5x + 6$; Evaluate $p(3)^2/p(3)$ for $p(x) = x^2 - 5x + 6$.



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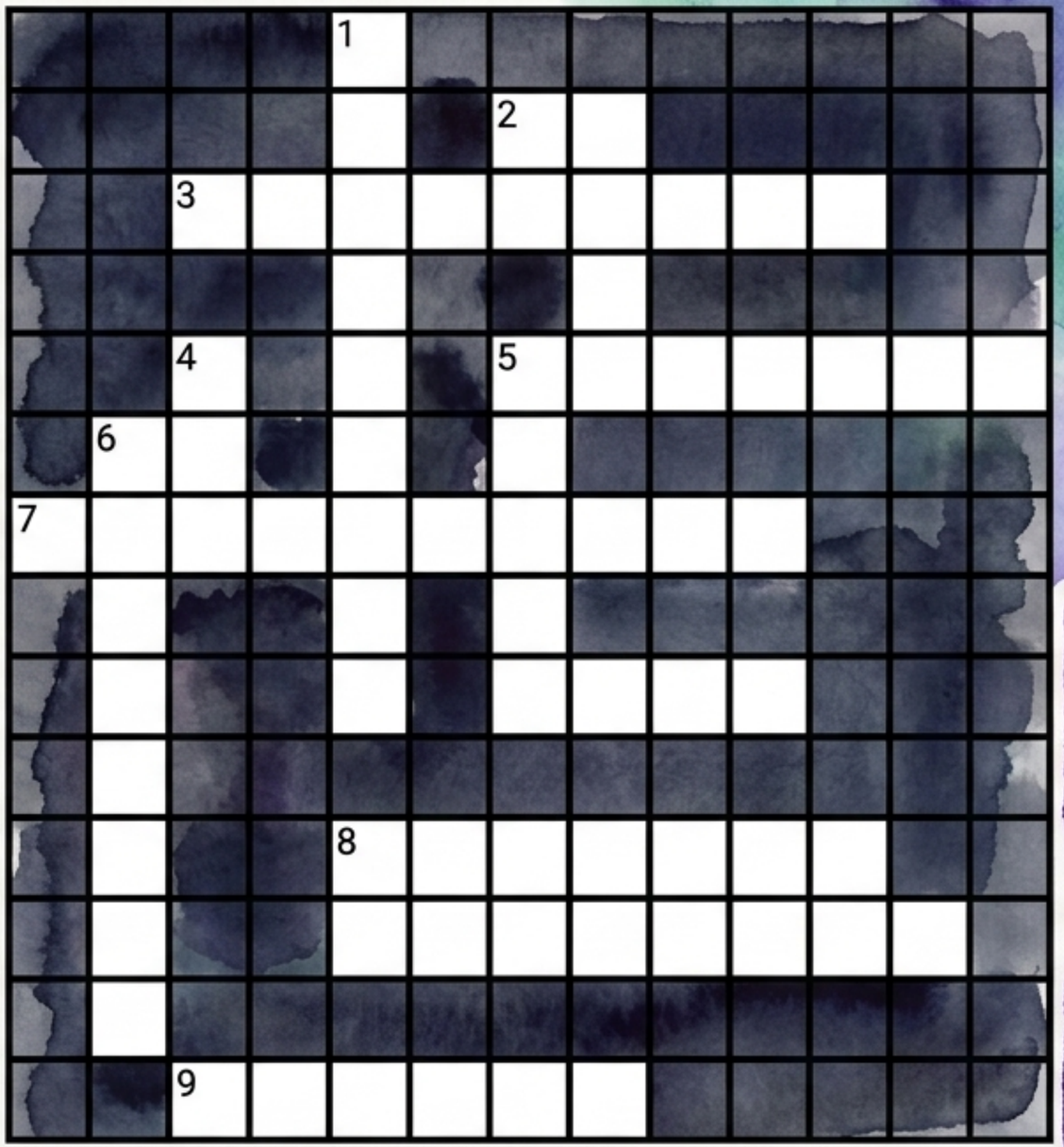
The Crossword
(Math vocabulary)



ACROSS:

3. A polynomial with exactly one term
5. The type of polynomial whose degree is 3
7. The number multiplying a power of the variable
8. The type of polynomial whose degree is 2
9. The type of polynomial whose degree is 1

DOWN:

1. A value of x at which p(x) equals 0
2. A polynomial with exactly two terms
4. A polynomial with exactly three terms
5. The term in a polynomial with no variable attached
6. An expression built from non-negative integer powers of one variable

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Number Search

Work out each answer, then find it hidden in the digit grid.

- ☐ 10
- ☐ 2
- ☐ 0
- ☐ 3
- ☐ 4
- ☐ 1
- ☐ 7
- ☐ 6

0	9	3	1	8	4	5	6	1	3
0	0	8	3	1	6	7	1	6	2
8	5	9	8	2	0	8	2	8	1
6	9	9	7	7	9	6	8	0	
0	1	3	4	5	6	7	1	4	
1	4	0	6	3	5	5	8	9	
8	2	0	6	0	8	0	3	6	
0	6	9	1	1	8	3	2	1	
4	0	4	7	5	9	0	8	7	
5	3	2	4	7	7	7	3	2	

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Magic Square

Every row, column and diagonal adds to 15. Fill the empty cells.

8		6
3		7
		2

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Concept Bingo · Term Bank

POLYNOMIAL	BINOMIAL	TRINOMIAL	MONOMIAL
ZERO	DEGREE	LINEAR	QUADRATIC
CUBIC	COEFFICIENT	CONSTANT	PARABOLA
FACTOR	ALPHA	BETA	GAMMA

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Spot the Mistake

(Audit the solutions. Find the planted error.)

Finding zeroes of $x^2 - 2x - 8$.
Step 1: Split middle term (nums multiplying to -8 and adding to -2 are -2 and 4).
Step 2: $x^2 - 2x - 8 = (x-2)(x+4)$.
Step 3: Zeroes are $x=2$ and $x=-4$.

The first wrong step is Step _____. It should say: _____

Sum-of-zeroes for $3x^2 + 5x - 2$.
Step 1: Zeroes 1/3 and -2.
Step 2: Sum = 1/3 + (-2) = -5/3.
Step 3: This should equal b/a = 5/3, so relationship fails.

The first wrong step is Step _____. It should say: _____

Building quadratic from sum = 4, product = 1.
Step 1: Use x^2 + (sum)x + (product).
Step 2: $x^2 + 4x + 1$.
Step 3: Check.

The first wrong step is Step _____. It should say: _____

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Quick-Fire Round · Matching

1. $x^2 + 7x + 10$
2. $x^2 - 3$
3. $x^2 - 2x - 8$
4. $x^2 + 5x + 6$
5. $x^2 + 3x + 2$
6. $x^2 - 5x + 6$

- -2, -3
- -1, -2
- 4, -2
- -2, -5
- 2, 3
- 3, -3

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True or False Sprint

1. Degree 3 can have at most 3 zeroes. T F
2. Quadratic always has exactly two zeroes. T F
3. Linear graph can cross x-axis twice. T F
4. $1/x + 1$ is a polynomial. T F
5. Sum of zeroes of $ax^2 + bx + c$ is $-b/a$. T F
6. Non-zero constant (like 7) is degree 0. T F
7. If graph doesn't touch x-axis, no real zero. T F
8. Product of zeroes of $ax^2 + bx + c$ is b/a. T F

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Two Truths and a Lie

(Circle the lie, then correct it.)

(a) Linear has 1 zero.
(b) Quadratic always has 2 distinct real zeroes.
(c) Cubic has at most 3 zeroes.

The lie is _____.
Corrected: _____

(a) Sum of zeroes is $-b/a$.
(b) Product is c/a.
(c) Product is $-c/a$.

The lie is _____.
Corrected: _____

(a) $x^2 - 3$ factorises as $(x-3)(x+3)$.
(b) Zeroes are 3 and -3.
(c) Sum of zeroes is 3.
(c) Sum of zeroes is 3.

The lie is _____.
Corrected: _____

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The Escape Challenge

(Unlock the Exit Code)

GATE 1:

What is the degree of the polynomial $5x^3 - 4x^2 + x - 2$?

GATE 2:

Find the zero of the linear polynomial $2x - 8$.

GATE 3:

For $x^2 + 7x + 10$, what is the sum of the zeroes (as a positive number, ignore sign)?

GATE 4:

For $x^2 + 5x + 6$, what is the product of the zeroes?

GATE 5:

What is the maximum number of zeroes a cubic polynomial can have?

EXIT CODE

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